

# High Performance Computing in our everyday life

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## Human Society

Scientific & Technical computing has brought about not only problem-solving but also “creating new value”.



Health &  
Safety

### Creating a Better Life

Contributing to a secure and prosperous society, through new drug development and improved weather forecasting.



Industry

### Innovating Manufacturing

Powerful new innovating manufacturing methods through high-speed, accurate analysis / simulation.



Science

### Unveiling Mysteries

Exploring the origins of humankind, space, and the universe through high-speed data processing and simulation.

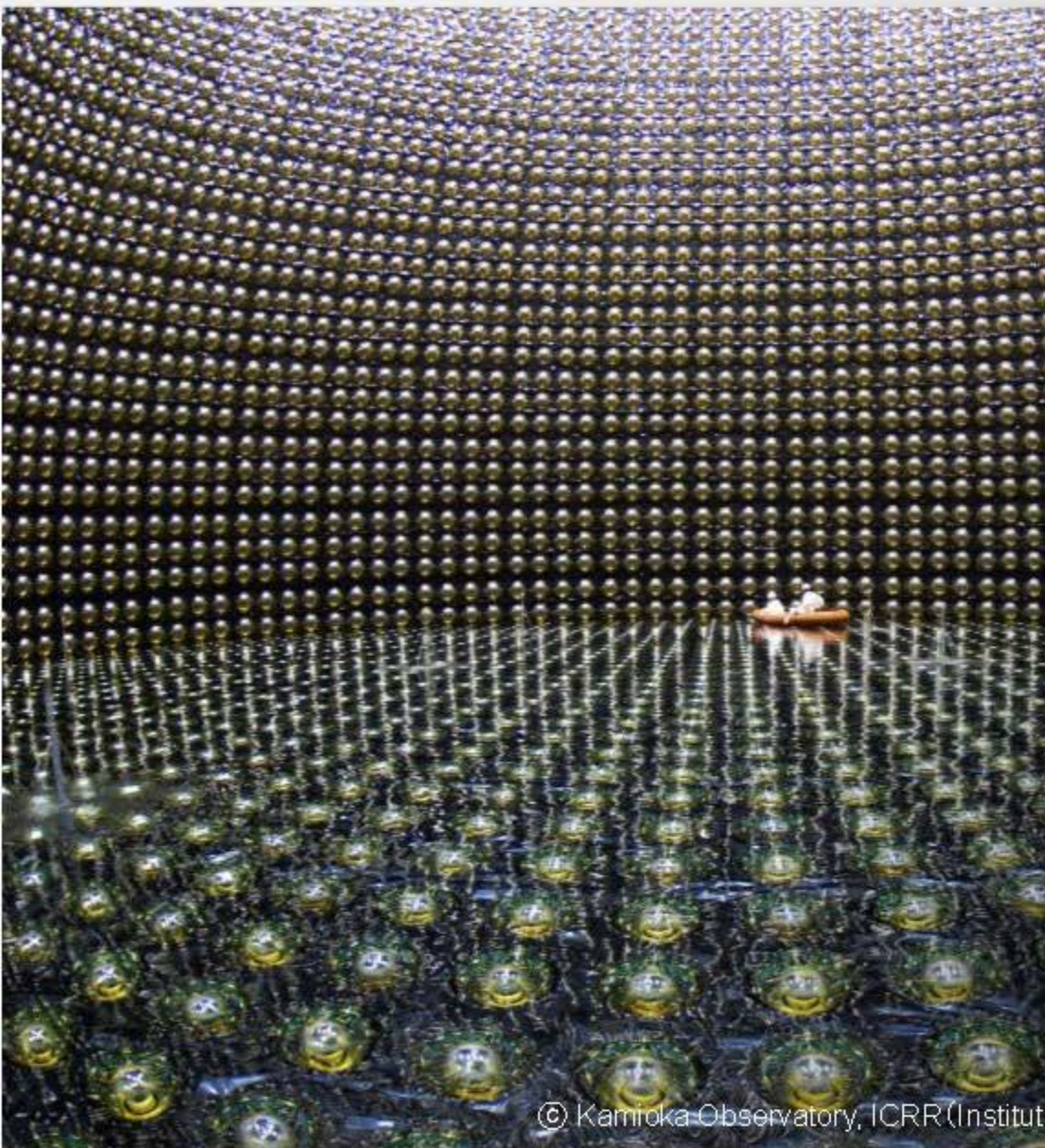


All start with Supercomputers...

FUJITSU



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## Astronomy



### Outline

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Experiment-analysis system for neutrinos and detection of proton decay, exploring the origins of the universe.

### Contribution

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Fujitsu installed a cluster system, running on a 24/7 basis, for analyzing neutrinos arriving from space, an accelerator and supernova explosions that may only appear once in every few decades. We support this Nobel Prize-level research, unveiling the mysteries of the universe.

# Neutrinos and Dark Matter Observation

To contribute to a greater understanding of the nature of neutrinos, dark matter, gravity waves, and the origins of the universe itself

## Subterranean Experiment Site

Super-Kamiokande Experimental Water Tank



Experiment Measurement Data

approx.  
**45TB / day**

Pre-processing Unit

approx.  
**500GB / day**

- Real-Time Processing
- Noise Reduction

## Calculation & Research Building (Outdoor system)



Data Analysis Unit

142 PRIMERGY BX922

S2  
Approx. 3PB storage

Data Server

Experiment Measurement Data

Backups etc.

approx.  
**150GB / day** Throughput Performance  
**960MG/s**  
(Average value for Read/Write)

**Project** | 「Super-Kamiokande」  
Experiment-Analysis System

**Client** | University of Tokyo,  
Institute for Cosmic Ray  
Research

## Technology & Solution

- A real-time processing system with high-reliability on a 24/7 basis and high-speed analytic performance, double of its predecessor.
- Noise reduction allows to assuredly select and store the important phenomenon being studied.
- Realizing more precise measurements than ever before and also reducing the time needed to analyze them.
- Promising efficiency in researching the differences in oscillations between neutrinos and anti-neutrinos.



## Astronomy



### Outline

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The world's largest radio telescope, ALMA, located 5,000 meters above sea level in Chile, has the world's highest resolution. This is the first collaborative project with both the US & Europe in NAOJ history.

### Contribution

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The ACA Correlator for ALMA, a ultra-high-speed data processing system Fujitsu created, brings answers to great cosmic mysteries, such as the origins of the universe and the planets inhabiting it.

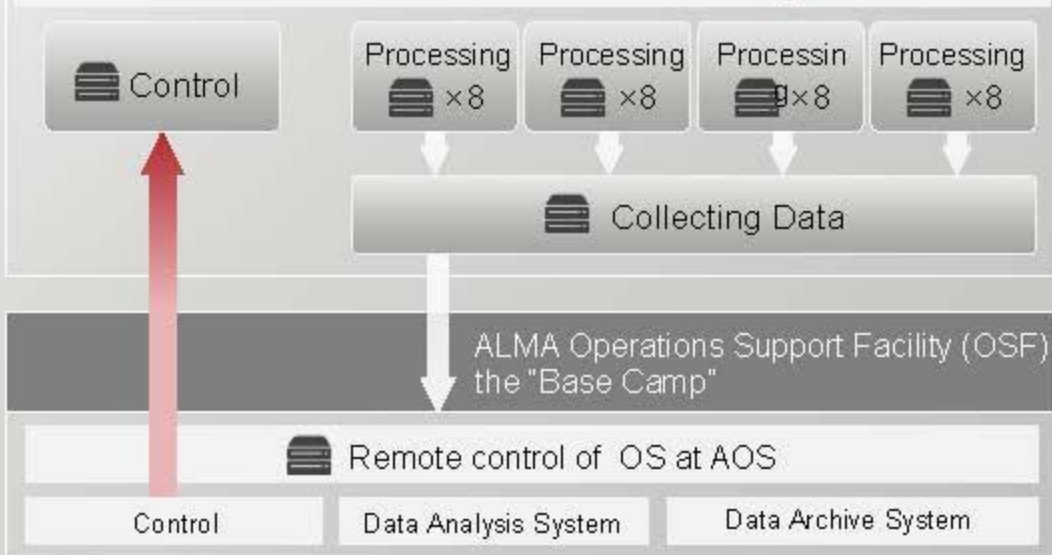
By identifying proto-star components in space, we can explore the origin of the planets and the galaxy, revealing cosmic mysteries.



16 antennas

ALMA Array Operations Site (AOS), located at an altitude of 5000 meters

Correlator Fourier transform of **1.5 Terabps**



= PRIMERGY RX300 S3

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**Project** | ALMA: The Atacama Large Millimeter/ Submillimeter Array

**Client** | National Astronomical Observatory of Japan

## Technology & Solution

- Developed dedicated hardware which is capable of real-time correlation processing. Observational data is transferred from the 16 antennas every second, each with a size of 1.5 Terabps.
- Achieves stable operation under severe conditions: operating at an altitude of 5,000 m and pressure of 0.5 atmospheres.
- Using diskless servers in accordance with severe environmental conditions at AOS.



## A\*STAR



### Outline

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Establish a center of excellence (CoE) to create urban development solutions which aim to build sustainable cities.

### Contribution

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Fujitsu aims to contribute to the growth of Singaporean society and the development of a sustainable city, through managing transportation and energy resources, creating an eco-friendly city, minimizing disasters, and creating new business.



# Utilizing Big Data

Aiming to create next-generation solutions for sustainable urban development

## Social Science Solution Research

Environmental pollution

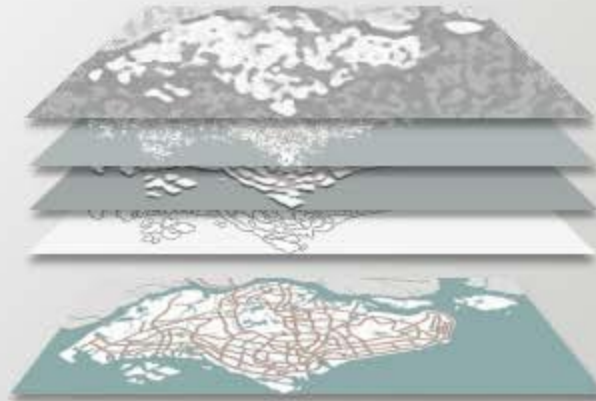
Disaster prevention

Epidemic prevention

Economic model

Urban planning problem

Business Model Research



Collaborative research

A\*STAR

Fujitsu

### Live data

Power information, Position information, Traffic information



### HPC/Big Data Management HPD bases

Data handling base

[ DBMS, MW ]

Data storage base

[ Server, Disk ]

High-speed calculation

base  
[ FX10, MW ]

Project

Utilizing big data for urban development solution research

Client

Agency for Science, Technology, and Research (A\*STAR)

## Technology & Solution

- High-speed big data processing technology.
- Computer simulation technology.
- Collaborative research in sustainable fields, such as creating an environmentally-friendly city, managing traffic, efficient energy use, and the “social system” using a computer.

## HPC



### Outline

A national project to improve the economic development by implementing supercomputer technology in Wales, UK.

### Contribution

As a research partner, Fujitsu and HPC Wales are collaborating to improve economic growth as well as technical capability in the area, by advancing the use of supercomputers in priority fields.

# Creating New Industries with HPC

We aim to make significant contributions to create a prosperous society, using HPC for priority research, such as global warming solutions.



## Improving Technological Capabilities

- Developing new technologies and highly-skilled human resources

## Developing Local Industries

- Creating **400** new job opportunities and more than **10** new businesses



PRIMERGY BX 900

1,400 nodes

190 TFLOPS

Project

Supercomputer Industrial Development Project

Client

HPC Wales

## Technology & Solution

- The distributed systems, consisting of 2 primary hubs with large-scale supercomputers and 6 middle-to- small scale ones, can be remotely accessed from various higher education institutions & private enterprises.
- Fujitsu supports these systems with more than 30-years expertise in supercomputer solutions.

# Issues the World Faces



Natural Disasters

Environmental Pollution

Climate Change

Overpopulation/Urbanization

Energy/Resource Exhaustion

New Disease Outbreaks



## Environment & Disaster Mitigation

### Outline

By installing environmental management systems, Japan and Thailand cooperated to improve on the aerial environment in the area around the Map Ta Phut Industrial Estate.

### Contribution

Fujitsu provided ICT-based environmental solutions that combines “air monitoring, environmental research and potential ability development”, which led to the contribution of solving environmental issues through multilayered action.



# Atmospheric Monitoring

Under the international cooperation of Japan and Thailand, industry, government, and academia united in an effort to solve environmental challenges.

Chulalongkorn University  
(Bangkok)

Kingdom of Thailand

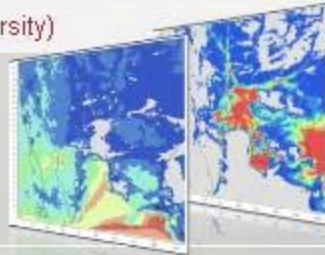
Map Ta Phut Industrial Estate



## Environmental Researchers (Chulalongkorn University)



- Japanese/Thai workshops
- Introduction of diffusion forecast PC cluster
- Simulation system



## Environmental Data Analysts (Industrial Estate Authority of Thailand)



- Measurement training
- Air monitoring system



## Citizens and Nearby Inhabitants



- Environmental education contents
- Website on Monitoring information



**Project** | Atmospheric Monitoring

**Client** | NSTDA Thailand National Science and Technology Development Agency, Chulalongkorn University, Industrial Estate Authority of Thailand  
CU,  
IEAT

## Technology & Solution

- Developed system to observe atmospheric concentration of VOC (volatile organic compounds) and release information to government organizations and nearby inhabitants.
- Introduction of PC cluster systems for running simulations on predictions of atmospheric diffusion of VOC.
- Implementation of various training to develop the abilities of system users, researchers, and nearby inhabitants.



## Environment & Disaster Mitigation



### Outline

Construction and operation of environmental monitoring systems in the primary industrial sites of Saudi Arabia.

### Contribution

In the primary industrial sites, Fujitsu has built an environmental monitoring system which constantly monitors air/water pollution. Moreover, we will contribute to environmental improvement by consulting the various data collected from this system.

# Eco-Friendly City

By improving the environment for industrial sites, and establishing a system for environmental conservation, we aim to bring an “Eco-Friendly City” into reality.



Installation of environmental monitoring systems

## 1 Air and Water Data collection

Ambient Air

Emission Air

Water  
(Ambient & Emission)



## 2 Data Observations & Analyses

Integrated Database

Monitoring



## 3 Environmental Consulting

Environmental Regulation

Eco-friendly City Examination



**Project** | MEMS (MODON Environment Management System)

**Client** | Saudi Industrial Property Authority

## Technology & Solution

- Centralized management of air/water observational data and the visualization of it using 3D maps provide effective, integrated monitoring services.
- Enables sequence of integrated operating processes which collect data, analyze it, and implement consultation based on the analyzed results.





## Space



### Outline

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“Sentinel Asia (Watchman of Asia)”  
An international cooperation project supporting disaster monitoring in the Asia-Pacific region.

### Contribution

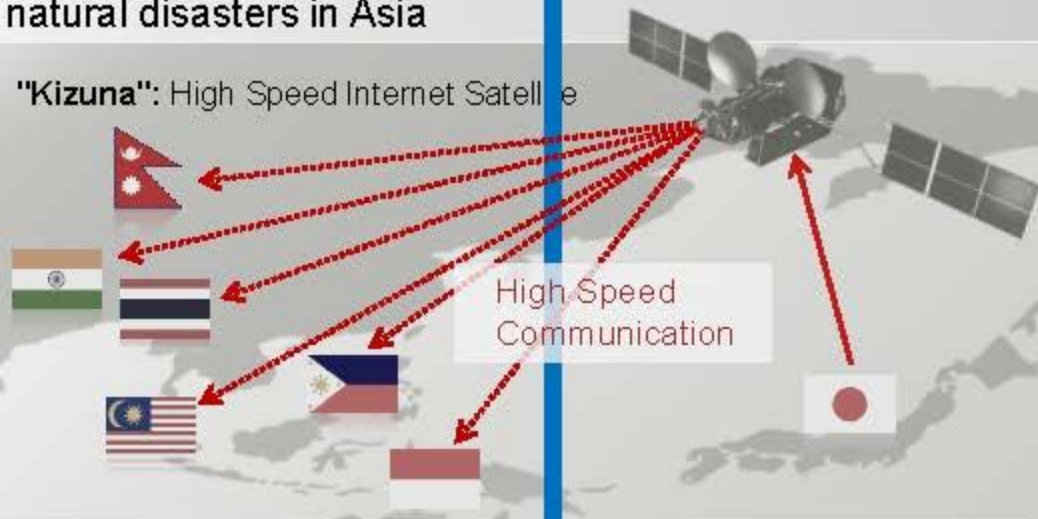
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By using high-speed file transferring technologies of its own, Fujitsu has developed a structure which can rapidly transmit satellite images in various countries throughout Asia to disaster preventing organizations, contributing to disaster prevention and crisis management in those regions.

# Utilization of Satellite Data for Disaster Management

Contributing to disaster prevention and crisis management through partnerships with victim countries of frequent natural disasters in Asia

"Kizuna": High Speed Internet Satellite



Disaster prevention organizations in Asian countries

### Use of satellite imagery

- Now used by 58 organizations in 23 different countries, as well as 9 international organizations.

JAXA Japan Aerospace Exploration Agency

### Control of "Kizuna"

- Transmits web content through WINDS

Sharing Platform of Natural Disaster Information

### Sharing / Use of Information

- Imagery information receivable even in areas without high-speed internet landlines access



Sentinel Asia Web site

Project | Sentinel Asia

Client | Japan Aerospace Exploration Agency (JAXA)

## Technology & Solution

- Effectively utilizes space technology, such as earth observation satellites and communications satellites.
- Utilizes ultra-speed internet satellite "Kizuna" (WINDS) to transmit data from Sentinel Asia to disaster prevention organizations around Asia.
- Provides fast, reliable file transfer services, which is independent from the network quality, using high-speed file transfer solution "BI.DAN-GUN".

## Real World

**Human Society**

The world we live in

**1** Data collection

**3** Data utilization

**New knowledge**

**Future predictions**

## Virtual World

**Application Solution**

**Platform Solution**

Creating New Knowledge  
Predicting the Future

**2** Data processing

Analysis

Simulation

Past and Present  
Data



**shaping tomorrow with you**